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an explanation and substitutes for Paleogene used throughout the book for the lower Tertiary the term Eogenic.

HERVEY W. SHIMER,
FREDERIC H. LAHEE

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Modes of Research in Genetics. By RAYMOND PEARL, Biologist of the Maine Agricultural Experiment Station. The Macmillan Company. Pp. 182. Price \$1.25.

In this book Professor Pearl has paused in the midst of his prolific and fruitful researches to put together in logical sequence around the central theme of methodology in genetics the substance of several of his recent papers and addresses.

There has been need enough for such a clear-cut analysis of the possibilities and limitations of the various methods now being utilized by workers in the expanding field of genetics and the author has performed this service most acceptably.

It is particularly gratifying to have a sane non-controversial evaluation of the much abused biometric method by one who is a past-master in biometry and is at the same time a biologist of notable attainment. It must be confessed that biometry of late years has rather needed a champion since non-mathematical biologists while admiring the magic of the biometrician, are often haunted with serious doubts about the value of the conclusions sometimes reached by this mode of investigation.

Although biometrics receives the most extended consideration of any method there is a comprehensive analysis of three other modes of research, namely, the Mendelian, the cytological and the embryological.

The next to the last, and the longest, chapter diverges into a somewhat technical treatment of the problem of inbreeding. Here the average lay reader is likely to ride through a tunnel with only intermittent glimpses of the light, but he is sure to emerge into broad daylight in the final chapter, which is upon "Genetics and Breeding," and feel well repaid for his journey. For any one engaged, or even interested, in genetic research Dr. Pearl's

book will prove a most welcome and illuminating volume.

It is obvious that "Table III." on page 111 should read Table I. H. E. WALTER

An Introduction to the Study of Variable Stars. By CAROLINE E. FURNESS, Ph.D. Boston, Houghton Mifflin Company. 1915. Pp. 327. \$1.75 net.

It is rather remarkable that no comprehensive work on variable stars had previously appeared in any language, though Hagen's extensive treatise, "Die veränderlichen Sterne," of which the first two parts have already been published, would soon have been completed had the war not delayed it. It is very timely in view of the great expansion in the past few years, not only in the observations of variable stars, but more especially in the deductions from their phenomena. Cosmic theories have drawn heavily on these phenomena, and seem likely to gain still more from further study.

Following the introductory chapter the work falls naturally into four divisions.

1. The equipment of the observer; maps, charts, catalogues: Chapters II. to V.

2. Photometry of variable stars; visual, photographic, photo-electric: Chapters VI. to VIII.

3. Reduction of the observations; light-scale, light-curves, elements and predictions: Chapters IX. to XI.

4. Deductions from these data; eclipsing and long-period variables, statistics, observing hints, tables: Chapters XII. to XV.

That the book is written from the standpoint of the teacher is well evidenced by the care taken to explain the fundamental ideas of each chapter. For example, the elements of spectrum analysis and radial velocity are given in considerable detail, a precaution very necessary to clarify the hazy ideas held by young students of spectroscopy. The principles underlying the photometric instruments are set forth in detail, especially the photo-electric appliances which have so recently entered the field of stellar photometry. A human interest is added by brief biographical sketches of some of the older great astron-

omers whose work laid the foundations for modern progress.

The amateur will thus find not only clear and complete directions for work, but the basic principles which enable him to understand the significance of his results. The professional astronomer will also find the book useful on account of its convenient collection of data for which he had been obliged previously to search through periodicals.

The specialist in astrophysics will naturally find some points capable of clearer statement, and some minor errors such as are apt to creep into first editions. For example, the Zöllner photometer is described on page 118 as used with the historic petroleum lamp, rather than with the modern incandescent lamp. The lack of wave-lengths on the margins of the engravings of spectra is puzzling to one not thoroughly familiar with them, especially as Plate XI. is printed with the violet end to the right, instead of the usual direction. Chapter XII., entitled "Eclipsing Binaries," includes also the "Cepheid Type," though it is not claimed that their changes can be explained by eclipses. On page 229 is the statement that "It was only with the selenium cell that it was possible to determine a change so small as 0.06 magnitude," though as a fact, the extra-focal photographs are capable of determining such changes. The use of *mg.* as an abbreviation for magnitude, is unfortunate, as it usually stands for milligram. Compare the statement in the *Scientific American* that the planet Saturn is 16 inches in diameter, due to the use of the double stroke as a sign of both inches and seconds of arc. This is not the place to give a list of typographical errors, but the statement at the top of page 102, that if star *A* is twice as bright as star *B*, the difference in magnitude is 0.44, might mislead. In the examples of the use of Pogson's rule, in Chapter V., the omission of the problem of finding the combined magnitude of two or more stars, is worth mentioning. In the historical part, the failure to give Mrs. Fleming credit for her part in the creation of the Harvard classification of stellar spectra; also the failure to credit the astronomer royal,

Christie, for the "square-root" formula for the reduction of the diameters of stellar images on photographs, to magnitudes, are minor points which might be corrected.

In spite of these minor criticisms the book is a worthy contribution to the series celebrating the semi-centennial of Vassar College.

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THE VITAL EQUILIBRIUM

FOLLOWING the suggestion of Nernst¹ that varying degrees of permeability of the plasma membrane might be due to a selective solubility of certain of its components, Overton established his lipoid theory. The most serious objection to Overton's theory is that, whereas it accounts most satisfactorily for the permeability of the cell for substances which normally play no part in the cell metabolism, it entirely fails to explain the penetration of sugars, salts and amino-acids, which must constitute an essential part of the cell income. Loeb² long ago emphasized the importance of the state of aggregation of the surface colloids as one factor influencing the conditions of permeability. This suggestion was made in connection with his experiments upon the effects of pure solutions of NaCl and combinations of NaCl and polyvalent ions on the eggs of *Fundulus*. Subsequent experiments by Loeb, Höber, Lillie and a host of others, have established beyond a doubt the existence of a physical-chemical relation between the state of aggregation of the cell colloids and the permeability of the cell. A precise and universal statement of the exact nature of this relation has never been made. In the following paper we shall attempt an analysis of the conditions determining the viscosity of cell surfaces and their importance; (1) in producing changes in permeability and (2) in "antagonisms." It appears that the metabolic

¹ Nernst, W., '90, *Zeitschr. f. physikal. Chem.*, 6, 37.

² Loeb, J., '01, *Pflügers Arch.*, 88, 68; '02, *Amer. Jour. of Physiol.*, 6, 411.